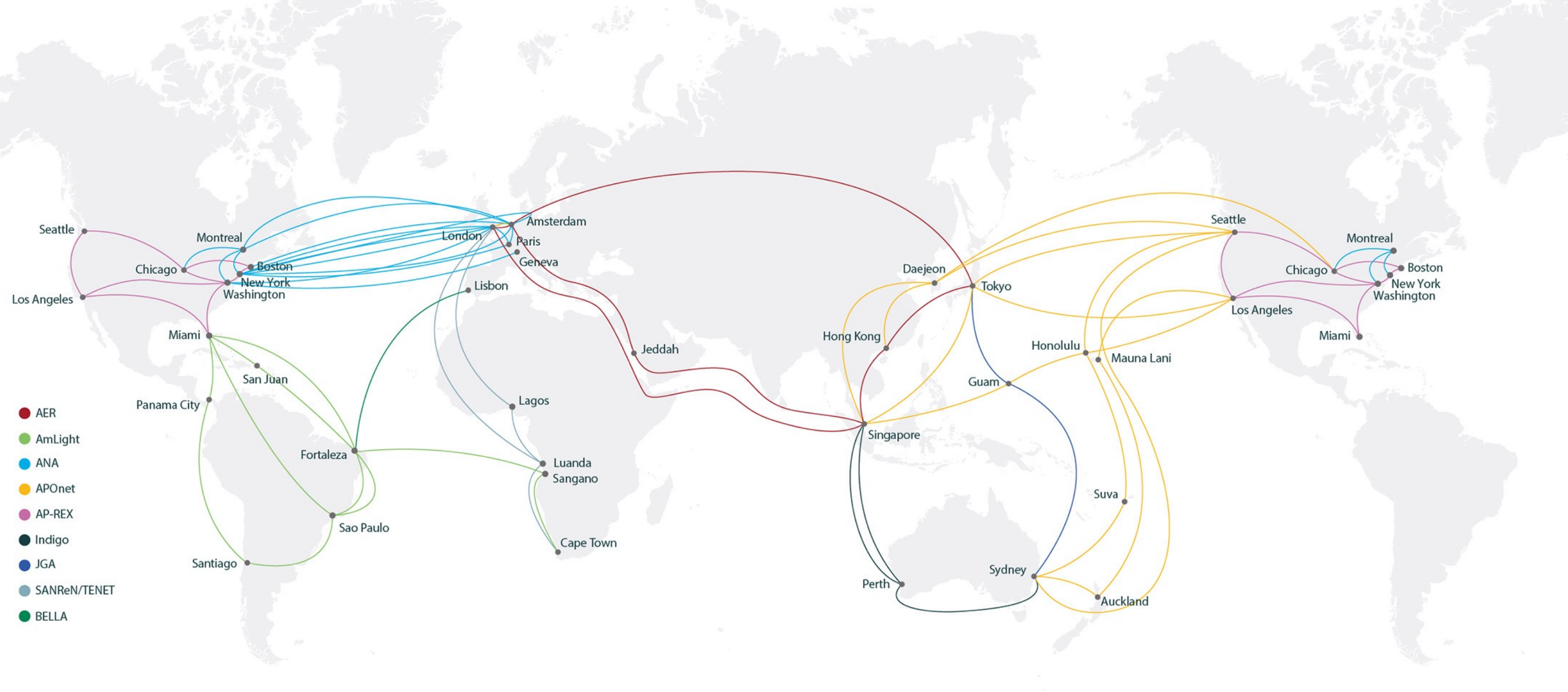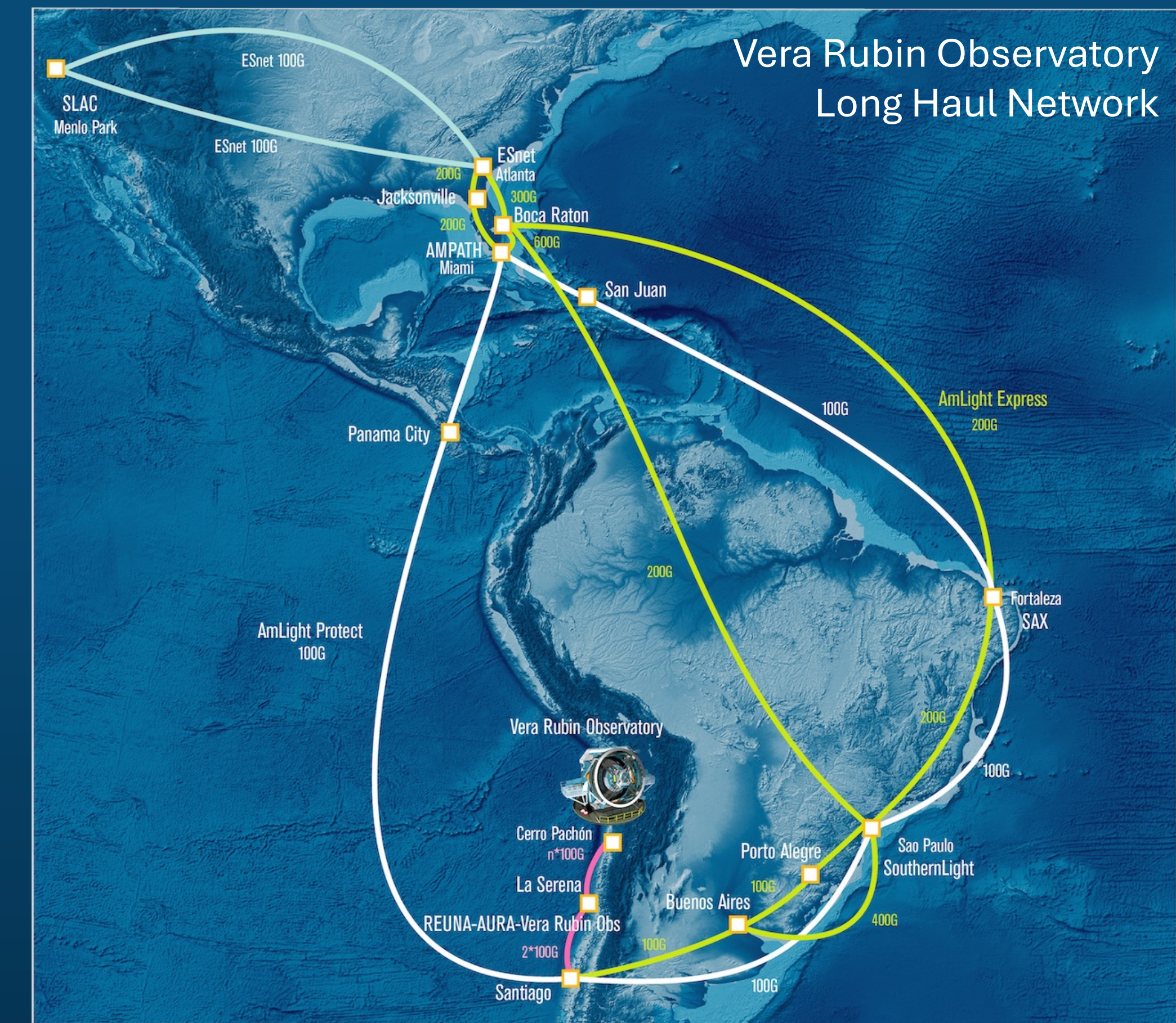# Supporting Research at Major Facilities by Leveraging Research and Education Networks

Julio Ibarra, Heidi Morgan, Jeronimo Bezerra, Luis Lopez, Vasilka Chergarova

Global Research and Educational Network (GREN)

Regions:	# NRENs:
USA & Canada	3
Latin America	9
North Africa, Western Asia, and Middle East	8
West and Central Africa	6
East and Southern Africa	12
Central Asia	2
Asia-Pacific	26

Vera Rubin Observatory Long Haul Network

AmLight Express and Protect Network:

- **600G** of upstream bandwidth between the U.S., Latin America, Caribbean and 100G to Africa (+400Gbps and +200Gbps in 2024)

- **Open Exchange Points** (**OXPs**): Florida(3), Brazil(2), Chile, Puerto Rico, Panama, and South Africa, New: Georgia (Atlanta), Argentina (Buenos Aires)

- Production SDN Infrastructure since 2014

- Deeply Programmable R&E Network Infrastructure

- **Highly instrumented**: PerfSonar, sFlow, Juniper Telemetry Interface (JTI), In-band Network Telemetry (INT)

- Vera Rubin will take a picture every 27 seconds

- Produces a 13GB image

- Each image is transferred within 5 seconds inside the 27 second transfer window, from the summit in Chile to the USDF at SLAC in Menlo Park

- 9 R&E networks, collaboratively, built the Vera Rubin Long Haul Network (LHN) to transport its images

600G Capacity

21 Programmable devices in production

Real Time In-band Network Telemetry (INT) & P4 capability

Connecting **2500+** research institutions

Dynamic provisioning SDN since **2014**

155+ Students involved